BfR

Risiken erkennen – Gesundheit schützen

Potential „new area“ such as Nanotechnology

Rolf F. Hertel

Essential Condition: Food Safety

Risk = Exposure x adverse effects

- exposure
  - external
  - internal
- adverse effects
  - reversible
  - irreversible
- severity code
- probability of an occurance

Nanomaterials: exposure scenarios

„natural“– soil, dust, aerosols, volcanic activity

unintentionally

„man made“ – eg. ultra fine dust (combustion product,
car-tyre abrasion, waste processing)

intentionally

„man made“ – eg. additives, „Canola Active Oil“ (Phytosterol 30 **nm**)
„Tip-Top Up Bread“ (Australia Omega 3),
LycoVit (BASF),
β-Carotin (The Carotenoid Company)

Safety concept

Farm			Fork
Agricultural Production	Production and Processing	Storage and Preservation	Consumption, functional foodstuffs

Use of nanomaterial / exposure to nanomaterial:
to facilitate / enable / optimise (economically) the process

Consequence: of interest are those effects due to
„new“ nanoscalic properties

Nanotechnology / Nanomaterial
Elements of a definition

- engineered / man made / manufactured
  (intentionally produced)

- dimensions - in the order of 100 nm

  - SSA (increasing with decreasing particle Ø)
    example: spheres of 100 nm Ø, unit density:
    60 m^2/g

- properties (characteristic to nanoscale vs bulk)

Forms of nanomaterials

- free particles
- aggregated / agglomerated
- embedded (in a matrix)
- coated
- colloidal systems

- emulsions
- micelles
- liposomes

- degradability, solubility

Relevant (adverse) effects

Important: Particle Toxicology

- oral exposure (discussing food)
- ADME (Absorption, Distribution, Metabolism, Excretion)

Absorption

Gastro-intestinal

unknown:

free particles or - transformation

- binding with components being present in the GI-tract

- Size of particles

  the smaller the better (Polystyrene, Latex)

- pass through epithelial cells

  - transcytosis (enterocytes / normal digestion)

  - transcytosis (M-Cells in Peyer´s patches)

- Pore size at tight junction: 0.3 – 0.1 nm

Distribution

- lymphatic system
- blood stream

- Liver, spleen, kidney,…
- interactions with proteins
- smaller-sized Particles: high widespread tissue distribution

Limited oral studies

Metabolism / Biotransformation

little knowledge

Excretion / Elimination

- urine, faeces,
- macrophages (lungs)

Toxicity

Oral studies are missing

in vitro

- generation of reactive oxygen spezies

  consequence: damage to nucleic acid bases
  membrane lipids
  proteins

  to question: physiological relevance (high doses applied)

in vivo

chronic studies are missing

Nano-Carrier systems

- to carry intended macromolecules into the body / cells

Concern: - carry unintended contaminantes

➡ immune reaction?

- particles in GI-tract

speculation: inflammatory responses

Conclusion

Toxicity (special : particles)

- Inflammatory responses
- Genotoxicity (?)
- Paracelsus: Dosis sola venenum facit

Exposure

- Routine analytical methods are missing to detect, characterize and measure Nanoparticles in biological matrices (food, feed)

At present Risk Assessment: high degree of uncertainty

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Thank you for your attention

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